



The Platform for Identity & Audit of AI Systems

Project Whitepaper

July 10 2018

<https://botchain.network>

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Disclaimer

The purpose of this white paper is to present the BotChain project to potential token holders in connection with the proposed project launch. The information set forth may not be exhaustive and does not imply any elements of a contractual relationship. Its sole purpose is to provide relevant and reasonable information to potential participants in order for them to determine whether to undertake further review of the network with the intent of acquiring BotCoin.

BotChain is an open source network, not owned by any single company. Nothing in this white paper constitutes a prospectus of any sort or a solicitation for investment, nor does it in any way pertain to an offering or a solicitation of an offer to buy any securities in any jurisdiction. This document is not composed in accordance with, and is not subject to, laws or regulations of any jurisdiction which are designed to protect investors.

Certain statements and estimates in this white paper constitute forward-looking statements or information. Such forward-looking statements or information involve known and unknown risks and uncertainties which may cause actual events or results to differ materially from the estimates or the results implied or expressed in such forward-looking statements.

This English-language white paper is the primary source of information about the BotChain business and token launch. The information contained herein may from time to time be translated into other languages or used in the course of written or verbal communications with existing and prospective customers, partners, etc. In the course of such translation or communication, some of the information contained herein may be lost, corrupted, or misrepresented. The accuracy of such alternative communications cannot be guaranteed. In the event of any conflicts or inconsistencies between such translations and communications and this official English-language white paper, the provisions of this English-language original document shall prevail.

About Talla

Talla is the company that originated the idea behind BotChain. Talla delivers an AI-powered knowledge base bringing enterprises into the future of automation and insight. The Talla platform uses machine learning to automate content management in IT or HR knowledge base contexts, keeping information up-to-date, relevant, organized, and accessible. Users access company knowledge bases through chat – providing rapid and easy means to find answers and maintain worker productivity.

Launched in 2015 by former Backupify.com co-founder (acquired by Datto) Rob May, Talla has raised over \$12 million with 2,500 existing AI installations across the enterprise.

About BotChain

Developed in response to market opportunity surfaced in Talla's enterprise artificial intelligence business, BotChain is a decentralized bot registration, identification, collaboration, and audit platform built on the Ethereum blockchain.

Setting the standard for bot compliance, BotChain allows bot developers, enterprises, software companies, and system integrators to verify bot identity, audit interactions, and control the boundaries of bot autonomy. By driving developmental software standards and creating a marketplace of developers and users, BotChain incentivizes bot innovation and adoption through secure and powerful intelligent machine usage within a range of enterprise environments.

A Word from the Project Founders

In 2016, Microsoft unveiled “Tay”, an artificial intelligence bot on Twitter described as an experiment in “conversational understanding”. The company believed that as users engaged Tay through casual and playful conversation, the smarter it would become. As [reported](#), however, the playfulness quickly wore off. Tay turned racist and misogynistic – repeating all sorts of foul sentiments back at users. Now, as AI starts to become more prevalent in enterprises of all types, what happens in those cases where an enterprise process follows the path of Tay and goes out of control?

In another [example](#) of AI gone bad, Boston University researchers trained a bot by exposing it to online stories collected via Google News. When asked to complete this sentence: “*Man is to computer programmer as woman is to ‘X’*”, the AI replied, “*Homemaker*”. In short order, these intelligent tools gleaned and spread culture’s most repugnant biases.

Then, in late 2017, perhaps the largest online advertising scam ever [was exposed](#), as bots created thousands of phony instances of publisher websites, including *The Financial Times*. This led major brands to purchase over \$1 million dollars per day in advertising on fake sites, with views being driven by bots impersonating human consumers. In total, bot-enabled advertising fraud is estimated to have cost companies \$16.4 billion last year.

As bot adoption and innovation accelerates, the mainstream failures are frightening. Software is becoming more intelligent; creating more powerful and less predictable bots. ***And yet, critical systems, standards, and means to validate, certify, and manage the millions of bots and billions of transactions powered by AI are effectively non-existent. Autonomous technology holds massive potential but is dangerously under-supported.***

BotChain’s platform introduces new levels of bot management, and eases developmental burdens. Our solution establishes an environment of healthy control and security, meaning artificial intelligence – perhaps the most significant technological advancement since the Internet – can thrive.

The founding project team and early partners have launched companies and driven them through exit. We have a deep bench of engineering leaders with the aptitude to use blockchain to solve AI’s thorniest problems. We have disrupted the enterprise, built consensus models, and know how to take software to market globally.

Thank you for your interest and partnership.

Rob May

Co-Founder & CEO – Talla,

Vision and Model Summary

At BotChain, our vision is to **create a first-of-its-kind solution, built on blockchain technology, that provides the platform *and* trust needed for AI-based systems to flourish.**

Tractica Research [forecasts](#) revenue from the application of AI software will grow from \$643 million in 2016 to \$36.8 billion by 2025, representing a remarkable CAGR of 56.8%. Research sponsored by Siemens [suggests](#) the market value of smart machine technology -- including intelligent agents, autonomous robots, and virtual reality assistants -- will eclipse \$41 billion by 2024. And by 2020, customers [will manage](#) 85% of their relationship with the enterprise without interacting with a human at all.

The tantalizing promise of revenue gains and cost savings are compelling the growth of AI in the enterprise. *While AI adoption is effectively underway, in many ways its incorporation is disturbingly ill-advised.* Bots are being launched and asked to do more and more with growing levels of power and autonomy. All this is happening without means for healthy audit, compliance, or a standardizing structure in place to manage and verify the integrity of bots and their activity.

Our team recognizes that, *despite the growth of bots and machine intelligence software, a lack of transparency, trust, and standardization limit the ultimate potential for this transformative technology.* Autonomy and learned behaviors, and the risks this smart technology introduces, threatens the future of full and secure enterprise adoption. Frankly, both enterprise IT and society at large are scared of the evolution of artificial intelligence – and for legitimate reasons.

*"As more organizations deploy intelligent robotic processes,
the need for BotChain is only going to grow"*

*Michael Maloney
Former Blockchain CTO at EY*

BotChain solves the fundamental limiting issue of ['black box' opacity](#) in how AIs make decisions and operate. The solution provides easy means to understand and improve bot responses and choices, while creating a vibrant ecosystem where bot software and service innovations are shared. This improves the quality and availability of autonomous agent technologies worldwide.

Literally billions of dollars across myriad industries and use cases still remain untouched by AI. These activities and processes are ripe for disruption, but unlocking the full potential of bots and similar machine intelligence depends on BotChain, its partners, and stakeholders. Together, we will validate or legitimize bots through an innovative identity-management system, issuing digital certificates -- stored on the blockchain -- to monitor bot behaviors.

By maintaining verifiable bot identities, storing activity, ensuring ethics, and creating a marketplace that spurs innovation in bot software, barriers to AI development and customer adoption will be lowered. This will ultimately benefit all ecosystem participants, ensuring new governance mechanisms to help the field grow in a scalable, principled, and profitable way.

To achieve this, BotChain will address three key challenges:

- **Transparency:** Currently, no system exists to map an auditable, decentralized trail that reflects the autonomous decisions made by bots. Nor does any system offer a clear path to retrain machine learning models to address bad machine behaviors. The example of “Tay” is a gross but reasonably benign example of why AI audit transparency is critical.
- **Standardization:** To reach maximum bot efficiency and return opportunity, there is a glaring need for standard protocols for autonomous systems which allow bots to communicate and, therefore, synchronize work across the network. This common AI management infrastructure does not currently exist.
- **Open Commerce:** As AI innovations progress and bot designs grow in complexity, the market remains fragmented. Developers, software companies, and enterprise consumers struggle to leverage advancements and capitalize on innovations from others, meaning the cycle of industry performance stalls. BotChain will establish the commercial environment for third parties to develop and acquire skill and knowledge modules to upgrade bot performance.

BotChain allows broad adoption of AI technology in a safe and secure way. Currently, beta deployment is underway and plans for intelligent agent auditing, compliance regulation development, and knowledge and skill sharing are in process. BotChain will create the platform and needed parameters to facilitate existing and emerging bot technology incorporation in every vein of the enterprise.

The time for BotChain is now.

As bots become more autonomous, they will sometimes make subpar decisions, much like humans do. Today, two applications communicate API to API, but what happens when these endpoints are suddenly intelligent and adaptive? What happens when bots negotiate with each other, and autonomously enter into smart contracts on behalf of a company?

Bot-to-human and bot-to-bot communication creates multiple problems with existing models of workflow- and agent-governance. For example, if a bot makes a simple decision on your behalf when talking to another bot, there is no independent, third-party, immutable trail of that conversation. What if you need to audit it? Re-training an agent is difficult when there is no record of its decision-making sequence.

BotChain solves these problems.

Just as humans require oversight and audits in the workplace to facilitate performance, compliance, knowledge-sharing, collaboration, and communication, bots also need a platform to secure these benefits, as well.

As societal fears rage about autonomous robot activity, enterprises forge ahead expanding the autonomous machine work use-cases. Quickly approaching is a world where hundreds of thousands of transactions will occur each minute. Some are human-to-bot; others are bot-to-bot, and some even involve a series of autonomous bots and humans in extended, complex sequences. Each transaction requires an immutable digital certificate to record what happened and why. Think of this as a digital receipt of each bot action.

BotChain reduces the fundamental, inhibiting frictions that will negatively impact this technology's return on investment. With the BotChain platform, AI-based enterprise business tools will enjoy breakthrough futures built on the principles of being decentralized, distributed, fast, reliable, rule-based, secure, transparent, and community ecosystem-driven.

Today, BotChain is well positioned for first-mover advantage. We have critical developmental processes already underway, with a developer partner beta release imminent. The impetus for BotChain comes from real challenges experienced in our AI work at Talla and similar peer AI companies. This problem identification and our vision and capabilities surrounding a solution are born from our industry leadership. Moreover, we have a promising community of developers, consumers and enterprises joining us. This shared, synergistic intelligence is a differentiator. Combined with blockchain architecture

roots, we can quickly outpace and maintain sophistication over any competing platform, should one emerge.

In short, we are pioneering the infrastructure needed to deliver the following to the bot, or intelligent agent, ecosystem:

- Bots with trustworthy identities
- Bots with certifications of compliance to standards
- Bots that can be monitored for performance
- Bot actions via trusted audit trail
- Bots capable of effective communication, collaboration, and negotiation
- Bots that can index, or 'know' other bots
- Trusted knowledge-sharing amongst bots
- Trusted, standard workflows across bots
- Means for human involvement via data analysis to improve bots
- Means for task completion between multiple bots

Capabilities & Platform Fundamentals

Behavior Audit & Compliance

One of the primary problems of building network businesses, regardless of target market, is that there is little value to early participants when the network is small. Both eBay and Craigslist, for example, are valuable by virtue of the fact that so many buyers and sellers are already on eBay and Craigslist. As such, few network-dependent businesses can attract a critical mass of users needed to sustain a profitable business model. The biggest concern of any blockchain network is whether there is ever a path to scale. Can the network show any value before it is large, or is it only valuable once many people are using it?

One way around this is to develop a product or service where participation on the network has *both independent value **and** network value*. The network attracts participants with some valuable utility, even if they are the only participant. However, that value grows as well when more users or participants join. By solving the audit and compliance issue facing bot developers and enterprises deploying any intelligent machine software or tools, BotChain's platform provides both.

In this section we want to focus on BotChain's audit and compliance use case, which is a use case that leverages the immutability of a distributed ledger to provide that single

use-case value proposition. We believe this will help us grow the BotChain network by providing value to participants even before the network is large.

Advances in bot development and design have given rise to a broad range of use cases and deployments. As industry adoption broadens and enterprise usage expands, compliance concerns and the resulting security and information vulnerabilities grow. Bots' deepening participation in workflows for entities that need to be HIPPA-, GDPR-, SOC2-, PCI-, or FINRA-compliant, for example, demands that companies or developers dependably confirm a bot's compliance.

In addition, since bots and autonomous agents are learning and adapting all the time, their behaviors are not entirely predictable. In a [recent article](#) for *Nautilus*, MIT professor Iyad Rahwan wrote, "*complex AI agents often exhibit inherent unpredictability: they demonstrate emergent behaviors that are impossible to predict with precision—even by their own programmers.*" This type of software cannot be deployed in enterprises without audit and compliance requirements.

As machine learning techniques are [already augmenting financial audits](#), the natural evolution is that the bots themselves will be audited to confirm the state of their compliance. However, today's challenge is this: *there is no standard or readily accessible way to audit bot or autonomous agent technology.*

BotChain allows for the creation and storing of digital certificates representing the state and activities of a bot at a given time. These digital certificates will be one-way cryptographic hashes of the state of the bot at that time. These certificates can be stored on the blockchain for immutability, ultimately validating the nature of bot activities to auditors or other parties interested in sampling and confirming compliance.

An example digital certificate may provide the following:

- Name or Version
- Authorized By
- Talking to
- Nature of Interaction
- Timestamp
- Model in Production:
- Training Set

Effectively, we have the version or type of bot, a record of who created or authorized its activity, who or what the bot was interacting with, and what it was doing at the time of digital recording. Rapid, efficient establishment of an unchangeable record of bot activity using digital certificates is of massive importance. This is particularly true as bot ecosystems grow and interactions advance with autonomous behavior via smart contracts and bot-to-bot communications.

As conventional business uses of bots change, the limits of existing regulatory and security frameworks will expand. BotChain provides the critical compliance and audit-test step that, by itself, is of inherent value. Additionally, as the compliance standard is set, the appeal of the network to bot developers and enterprise customers grows. This move toward shared standards and platform-network benefits will consistently reinforce and then boost BotChain's value.

Consider the pressing need for a framework for compliance and audit capabilities in light of this perspective from the aforementioned MIT Media Lab Nautilus article:

[emphasis ours]

*... Substantial economic value can be unlocked by studying machine behavior. For example, **if we can certify that a given algorithm satisfies certain ethical, cultural, or economic standards of behavior, we may be able to market it as such. Consequently, consumers and responsible corporations may start demanding such certification.** This is akin to the way consumers have started demanding certain ethical and environmental standards be met in the supply chains that produce the goods and services they consume. A science of machine behavior can lay the foundation for such objective certification for AI agents.*

Artificially intelligent machines increasingly mediate our social, economic, and political interactions: Credit scoring algorithms determine who can get a loan; algorithmic trading programs buy and sell financial assets on the stock market; algorithms optimize dispatch in local policing; programs for algorithmic sentencing now influence who is given parole; autonomous cars drive multi-ton boxes of metal in our urban environments; robots map our homes and perform regular household cleaning; algorithms influence who gets matched with whom in online dating [...] In the near future, software and hardware agents driven by artificial intelligence (AI) will permeate every aspect of society.

Registry and Identify Validation

As autonomous agents take on more responsibility and increasingly deliver process and service functions, users run into a problem: *how do they know a bot is who it says it is, can do what it is asking permission to do, and is owned by who it claims to be owned or managed by?*

Akin to the email or website spoofing (“falsifying”) [scams](#) common today, bot spoofing is becoming a real threat. As bot interactions with average consumers become more common (think: chat popups with a cable television provider or SMS messages confirming credit card or bank activity), validating bot identity to ascertain its legitimacy is critical.

The perils of bot impersonation are significant. Every day, data breaches and scam stories mar the news landscape. These seed further skepticism around the looming effects of intelligent-machine activity in society’s collective psyche. Users *need* to be able to determine bot trustworthiness.

As an example, when you visit starbucks.com today, a small green bar in your browser shows you it has a digital certificate that proves it is owned by Starbucks. But if you suddenly received a text, Telegram, or other bot-related message from an AI claiming to be the Starbucks bot and asking you to enter your credit card for payment, you have no idea if that bot is really owned by Starbucks.

BotChain solves this problem through a universal tokenized decentralized bot registry which can provide reliable identify validation. This platform service means that bot developers or enterprises deploying bot technology can register their bots and receive a unique bot-identifying code. When a bot presents itself, makes a user inquiry, or seeks permission to perform a task – automated or otherwise – the other party can verify the bot’s identity using a public/private key combination.

BotChain effectively becomes the ledger of bot instances that allows for validation during conversations, requests, and interactions with other bots. Leveraging blockchain technology via BotChain provides both the validating means for bot identification while *also* creating a ledger of activity so that all interactions and corresponding actions are tracked. Bad behavior, dishonest activity manipulation, and spoofing are all effectively addressed with registry and validation functionality.

In a [recent article](#) on faulty reward and malfunctioning smart behaviors in AI, leading industry research company OpenAI calls out an important issue around reinforcement learning, or the process by which bots and other intelligent machines automatically determine, iteratively, the ideal behavior within a specific context to maximize performance.

Their findings lend credence to BotChain and substantiate the need for an auditable trail of bot activity to course-correct bot decision-making and improve future behavior.

One of the games we've been training on is [CoastRunners](#). The goal of the game - as understood by most humans - is to finish the boat race quickly and (preferably) ahead of other players. CoastRunners does not directly reward the player's progression around the course, instead the player earns higher scores by hitting targets laid out along the route.

We assumed the score the player earned would reflect the informal goal of finishing the race, so we included the game in an internal benchmark designed to measure the performance of reinforcement learning systems on racing games. However, it turned out that the targets were laid out in such a way that the reinforcement learning agent could gain a high score without having to finish the course. This led to some unexpected behavior when we trained an RL agent to play the game.

The agent finds an isolated lagoon where it can turn in a large circle and repeatedly knock over three targets, timing its movement so as to always knock over the targets just as they repopulate. Despite repeatedly catching on fire, crashing into other boats, and going the wrong way on the track, our agent manages to achieve a higher score using this strategy than is possible by completing the course in the normal way.

While harmless and amusing in the context of a video game, this kind of behavior points to a more general issue with reinforcement learning: it is often difficult or infeasible to capture exactly what we want an agent to do, and as a result we

frequently end up using imperfect but easily measured proxies.... Often this works well, but sometimes it leads to undesired or even dangerous actions. More broadly it contravenes the basic engineering principle that systems should be reliable and predictable.

OpenAI's research point is this: **to establish the right AI behavior that imitates the ideal or appropriate human response, human feedback and evaluation opportunities are critical.** But as bot activity grows increasingly autonomous, in particular with bot-to-bot engagement in lower skill service and transactional activity, a record of activities must be unalterably kept to train, monitor, revise, and improve future behavior. Activity hashing to a blockchain ledger delivers this.

Marketplace & Ecosystem Exchange

Today, the SaaS playbook suggests that, when a company hits a certain size, they launch an API and a marketplace to allow third-party developers to build, develop, and integrate with the platform. The company gate-keeps the marketplace and carves out a substantial cut of any revenue generated from marketplace commerce. While to a degree profitable, this is not an optimal outcome for the ecosystem.

The conventional app marketplace model it reinforces a winner-take-most game, as third parties decide who to build for (i.e. – build for Salesforce.com first and smaller CRMs later) and they usually settle on the tech giants. It puts too much control in the hands of a dominant platform or marketplace provider who can effectively manipulate the marketplace or app store.

BotChain believes that a blockchain-based option could improve the existing marketplace approach. By forming a consortium of participants in agreement on interoperability standards, a powerful marketplace solution that equitably and generously incentivizes developers, software providers, and enterprise customers can be formed. By incorporating blockchain, every major B2B company could participate on the network, but no one company would exert ultimate control. The rules would be set by consensus and voting, and the blockchain could be designed to enforce the rules built into the protocol.

With the open marketplace and an API-like standard in place, developers could write once and register their tool on a blockchain that is effectively a shared B2B environment across automated agents or bot apps. Their app is would be instantly discoverable, with near plug-and-play compatibility in a variety of applications, rather than just the one or two app platforms they built for. This puts the onus of supporting the shared standard on the large

B2B company that wants the app ecosystem, not the smaller developer trying to build an add-on.

By incorporating a shared currency -- BotCoin -- these transactions can work across companies, globally, in an elegant and unified way. It circumvents the payment remittance and processing challenges that keep certain geographies excluded from marketplace participation. It also reduces barriers to development and customer adoption of third party applications. By sharing value, *more* value will actually accrue to the third-party developers and other ecosystem participants.

Partnership Development

A critical component of healthy marketplace and AI ecosystem is the development of a rich, collaborative partner environment. Before launching its beta, BotChain has already secured a critical mass of aligned partners who together comprise:

- 50,000 developers
- 150,000+ enterprise- and consumer-facing bots
- 400 million end users
- 4 billion monthly interactions

Mutually beneficial partnership and healthy incentives are critical to overcoming the remaining hurdles to widespread, trusted deployments of AI across the enterprise worldwide. BotChain's open-sourced code allows for development of new services and transparent crypto-earning, benefiting everyone on the network.

The vision to build a partner-centric blockchain ecosystem is based on four key components:

1. Decentralized governance
2. Open-sourced and collaborative software
3. Partner-motivating token incentive structure
4. Ecosystem relationship development and communication

Early on, BotChain is setting aside a percentage of generated tokens to incentivize and reward partner participation. Initially, we will fund partners to perform platform work like bot registration or decision-hashing to create network value. Thereafter, we will deliver token rewards for other contributory value such as node hosting or identity validation on the

blockchain. Clear paths of earning and spending will remain in our purview, while governance practices will maintain the inherent health and fairness of the platform.

Currently, our early partners are actively involved in testing, development, and feature feedback. BotChain's partnership team is prioritizing Github, a developer page, API documentation, conferences, and a team of dedicated developer evangelists -- all to encourage and support the fast organic growth of the BotChain partner network.

The Role of Blockchain

Critical Technology for BotChain

The emergence of blockchain technology means a solution for the age-old problem of ensuring verifiability, authenticity, and auditability in a transaction. This is not one unique to AI, bots, autonomous agents, or any intelligent technology interaction, but is central to establishing trust – an integral element of any transaction.

The benefits of blockchain technology have been long advocated for by those in the cryptocurrency space. **Notably, bots and digital currencies share similar security issues, making an Ethereum-based blockchain solution particularly useful.**

BotChain builds on the Ethereum blockchain and, employing a distributed resource on the internet, posts a record of all bot activities on a common, shared, widely-viewable, and secure ledger. BotChain creates the means by which bot-based transactions are viewed and audited, which means that users, businesses, and consumers can ensure bot actions are being performed appropriately by legitimate agents. And, should bad behavior be recognized, the activity trail is traceable to drive an appropriate resolution -- including manual improvement of the agent or the structured re-learning of appropriate activity by an AI system. This creates improved future behaviors and keeps bots operating within the scope of their rights and design.

To summarize blockchain's critical role in BotChain's solution, we believe the use of technology delivers:

- *Trustworthiness*: The blockchain can become a trustworthy networked supplier of services among many organizations building and operating bots
- *Transactional Guarantee*: A key characteristic of a blockchain technology is the ability to solidify a transaction among one or many parties. Once a transaction is submitted within the blockchain environment, it has a high probability of execution.
- *Immutability*: Records of what a bot did and why can be stored safely by a networked, trustworthy blockchain standard, making it ideal for single-bot solutions, or workflows involving many bots that may be owned by different entities.
- *Shared Economic Value*: The work of maintaining a blockchain solution is done by multiple nodes that get paid fees for completing work. This creates an ecosystem that can maintain a fair cost structure for all parties.
- *Community Involvement*: Companies that create bots and associated applications also have an incentive to create and maintain a blockchain solution to serve their needs as a community

Ecosystem Token

Introducing BotCoin

BotCoin is a utility token based on the ERC20 standard of Ethereum. BotCoin, or BOTC, will serve as the internal cryptocurrency that brings together all participants in the ecosystem and drive them towards achieving common network goals. BotCoin will serve as the oil that powers the BotChain engine by organizing and shaping the key forces that drive the network to create value.

BotCoin - An ERC20 Token

BotCoin token uses the prominent ERC20 standard, which ensures compatibility with popular wallets. Ethereum-based tokens rely on an established infrastructure, benefiting from the following properties:

- *Security* - The Ethereum Network is currently secured by miners providing over 250,000 GH/s. This ensures the immutability of data on the network.
- *Predictability* - Hundreds of ICOs have been launched using the ERC20 template.
- *Robust Clients* - ERC20 tokens can be managed with official Ethereum clients and wallets that have a large development community supporting them.

- Simplified Integration - Tokens are easily exchanged with other Ethereum-based tokens, and exchanges already have infrastructure in place to facilitate integration.
- Adaptability - Ethereum smart contracts provide a transparent and secure way of transmitting payment, providing platform access and facilitating work done to build blocks on Ethereum network

Why BotCoin?

By using a dedicated token (BotCoin), to facilitate all transactions in the BotChain network, we are building a truly global distributed network that can be used across any number of jurisdictions, retaining a single uniform method of settlement. Also, using a specialized token that is tied to the BotChain ecosystem shields the ecosystem from extraneous considerations regarding the volatility of other cryptocurrencies.

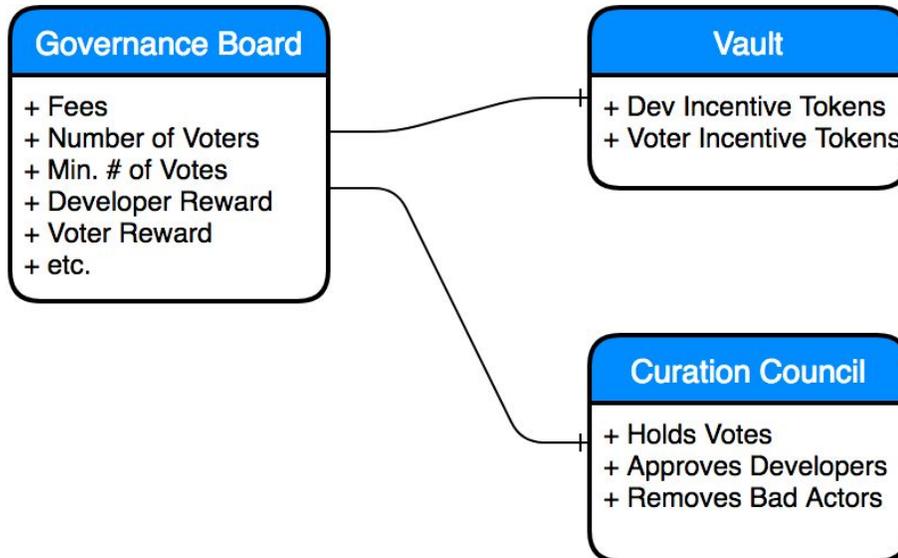
The other major reason is that BotCoin can help manage incentives that drive ecosystem adoption and growth. Network service providers who provide value added services will earn BotCoin for the services that they provide. Additionally, members of the BotChain Core system will be able to earn BotCoin as part of the protocol by providing governance actions that help to enhance the network and aid in ecosystem growth.

Role of BotCoin

BotCoin Enables Network Governance

BotCoin plays various roles - as a value exchange and as an incentivization engine to drive the creation of an internal network economy. The creation of such an internal economy is arguably one of the most important outcomes for the network, and one that must be sustained over time with help of an agile governance framework.

The key to a good Governance model is to have good rules on how to earn and spend BotCoins in the network. In addition to the Governance board we also introduce two new actors - the **Token Vault**, and the **Curation Council** - who would play key roles in the day to day execution of the rules set up by the Governance Board.



Governance Board

The Governance Board is best thought of as the group in the system that creates or modifies the rules for all other actors to adhere to. Quarterly meetings will be held to discuss the state of the network, and emergency meetings can be held on an as-needed basis. The initial Board will be composed of 9 members, which will be selected by the founding organization with the following guidelines:

- Founders will have one seat, as the originating company behind the network.
- Two seats will go to companies that use the network.
- One seat will go to a bot/AI/RPA platform company.
- One seat will go to an audit and compliance person/firm.
- One seat will go to a crypto/blockchain independent contributor.
- One seat will go to an AI policy person.
- Two seats will go to general independents.

Note: None of the seats are required to hold Bitcoin in order to participate.

Upon founding, candidates for the first four seats will be selected by the founding team and they will have a 1 year tenure. Those seats will then nominate and collectively vote in order to fill the remaining seats. Those newer seats will have 2 year tenure. The Governance Board will vote on forks, roll backs, upgrades, and will intervene if any major negative behavior is impacting the utility of Bitcoin.

Token Vault

Token Vault is a multisignature contract designed to store all BotCoins related to the incentivization of useful actions within the system.

Curation Council

If the Governance Board members are thought of as the rule makers of the system, the Council can be considered the enforcers and executors, through their work product, of the provided rules. The curation council works like a digital certificate authority where a member will verify certain information about a bot and its owner. The work done by the curators is rewarded in BotCoin to provide incentive for positive actions. To further ensure curators will behave in the best interest of the network, an individual or entity must first apply to become a curator and then be approved by the founding team, Governance Board, or designates at founding team's discretion. It is worth noting and clarifying that curation members have no protocol or business direction decision rights.

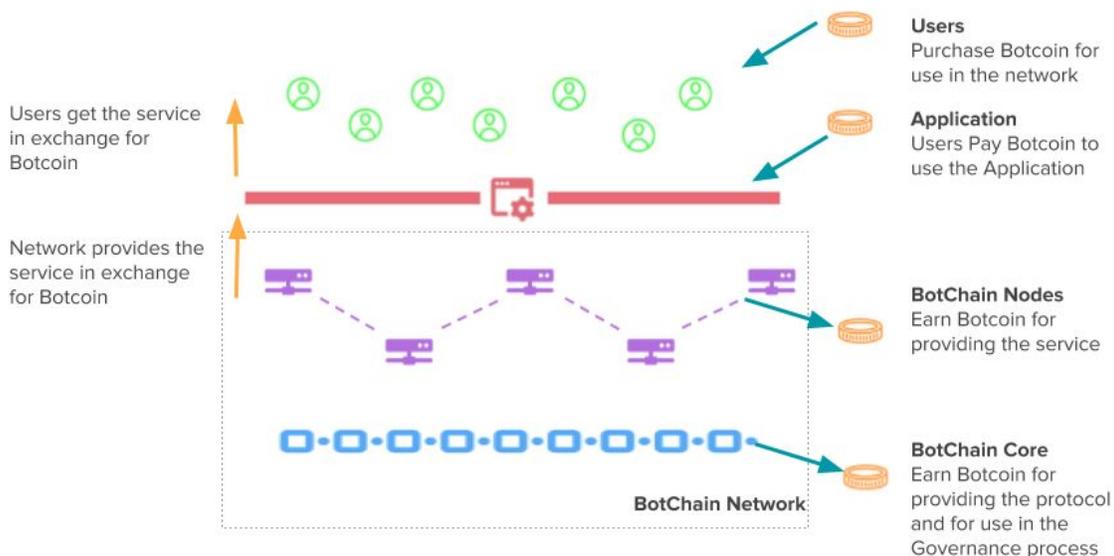
BotCoin Drives Network Growth

BotCoin enables creation of a robust transactional economy that rewards actors in exchange for the work that they provide for the Network.

How does this economy function?



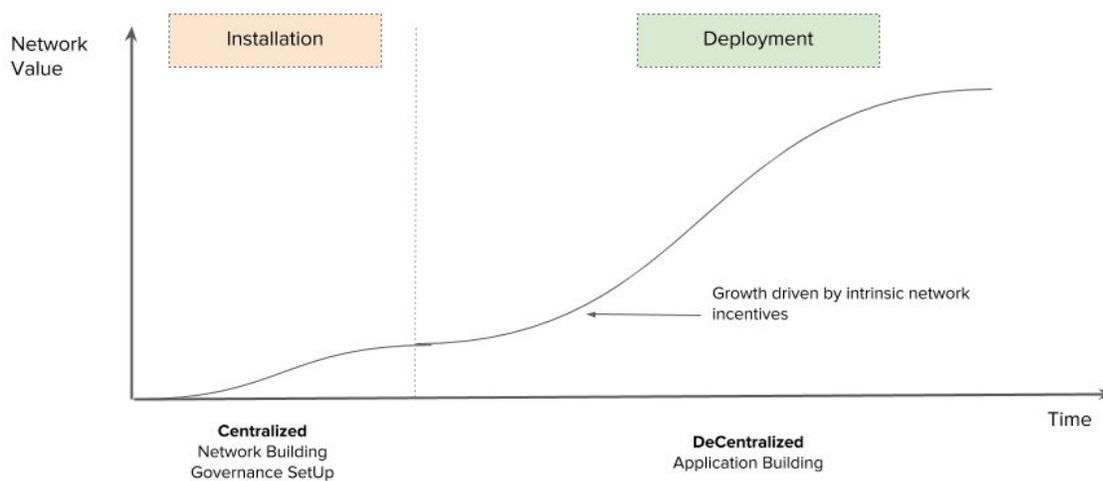
Role of Botcoin in BotChain



Users interact with applications built on top of the BotChain network. These applications likely solve use cases such as Identity, Audit & Compliance that directly enrich the value for these users. Users pay to access these applications. The BotChain nodes that provide these services will in turn earn BotCoin for its usage. BotChain Core, which runs on the blockchain, provides an immutable data storage layer and in turn earns BotCoins for providing this function. In essence, BotCoin acts as a binding agent to bring all of these decentralized actors together with the right incentives and value that benefits each and every individual participant in the network.

BotCoin incentivizes all participants to contribute to the network. The ecosystem is expected to mature such that BotChain and third party service providers will provide applications and services in exchange for BotCoin.

Token Economics that drive Network Adoption & Growth



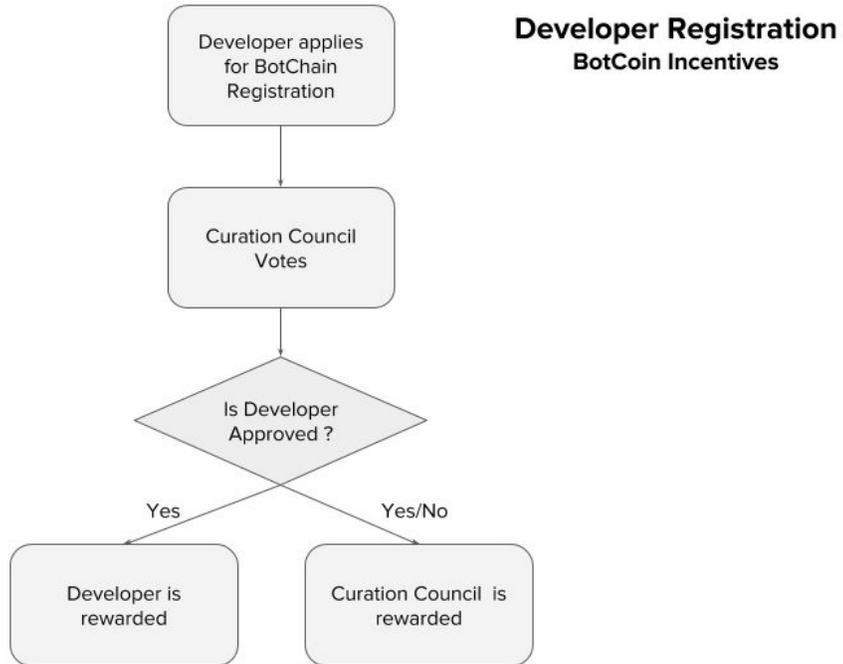
The above chart is based on [Carlota Perez's Technology Surge Cycle](#)

BotCoin Incentivizes Network Adoption

Building a network is not easy. In order to build a valuable network, there needs to be specific linkage between user behavior and the resulting effects of the user behavior on the overall value of the network. Having early adopter incentives to bootstrap user activity is fundamental to the adoption of the network.

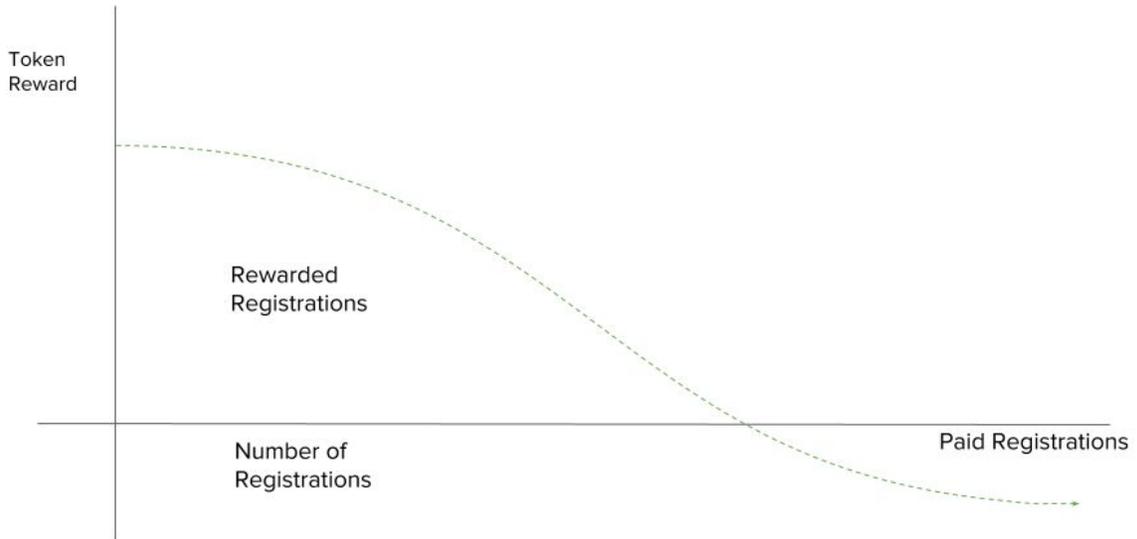
During the early phases of network building, BotChain will incentivize early bot and autonomous agent developers who register with BotChain. As described earlier, the Curation Council will vote on whether a developer can be registered in BotChain or not.

Once successfully registered, the user will be rewarded with BotCoins. The Curation Council will be rewarded irrespective of the developer registration outcomes. The incentives will be set by the Governance board and executed by the Curation Council by means of the Token Vault.



The Vault Contract will be created with two separate accounts, one for the voter subsidies and one for the developer registration subsidies. For each account there will be a function that acts as a faucet for either voting or an accepted registration. Both functions will require a function that specifies the amount of Botcoin issued for each call. The function should be asymptotic, meaning that it should decline towards zero on each subsequent call.

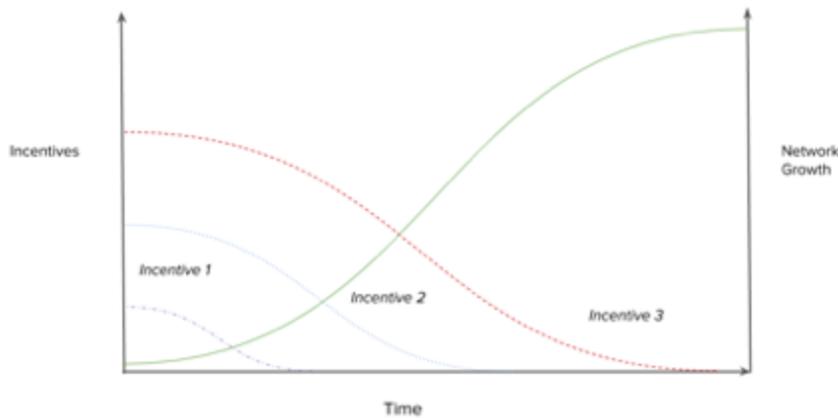
Registration Reward / Payment Curve



BotCoin Empowers Network Innovation

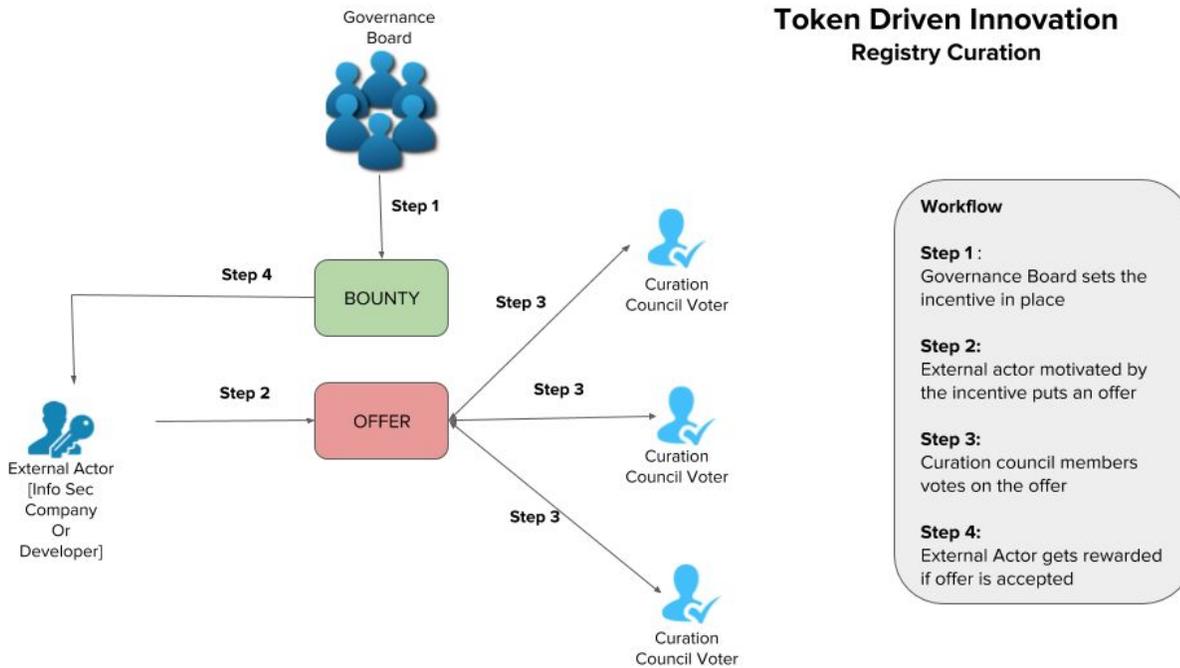
The sustained growth of the BotChain network is dependent on creating applications that enrich and create value for end users. Building network incentives that reward creation of new experiences or addition of new ecosystem data or curation of existing data that help grow the network is critical to the long term success of the network.

Token Incentives to promote Network Growth



Token Driven Curation

Token Driven Curation is one that of the examples that highlights the role of BotCoin as an incentive mechanism to curate the BotChain registry.



Registry Challenge

At any time a developer or an external actor has the ability to challenge the reputation of any Service, Developer, Bot, or Instance. An entity's reputation is maintained for the duration of its existence. At any point in time a developer or a infosec company can challenge the reputation of an entity by raising an offer in BotCoins. A vote is then raised to the Curation Council, who will decide whether the entity should be delisted. If the vote successfully delists an entity the bounty is issued to the challenger.

Curator Voting

When a reputation challenge is raised to the curation council it begins a voting phase that lasts for [a period of time]. During this period, each member of the council has the ability to place a vote on whether they believe the entity to be a good or bad actor. After the duration of the voting period the side with the largest total voting power wins and collects a reward from the pot that is proportional to their initial bid.

Governance Board Veto

At any point during a reputation challenge voting period the board has the ability to veto a challenge by a two-thirds vote.

Sample Industry Applications

Robotic Process Automation (RPA)

Robotic process automation, or RPA, is technology designed to automate business processes. By [using RPA](#), “a company can configure software, or a 'robot,' to capture and interpret applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems.”

RPA is ideal for repetitive, mundane, rules-based businesses processes where accuracy and speed matter, but where reasoning and emotional intelligence are not essential. One common use case is for insurance companies using RPA to move policy management data into a claims processing application, rather than being encumbered with the costs and error liabilities of using low-skilled human help. Industry news leader CIO.com [writes](#) that, with RPA, companies can complete in “...days or weeks manual processes that previously took months or years, and at a fraction of the cost.” Their report continues, suggesting that spending on RPA software will reach \$1 billion by 2020, at a 41% CAGR from 2015 to 2020. They expect 40% of large enterprises to have adopted a RPA tool by 2020, up from 10% today.

But as RPA and its automation use cases expand in the enterprise, software vulnerabilities and security risks will grow. BotChain establishes the means for autonomous bot activity to be securely captured and reviewed. By supporting a broad credential-management effort, developers or IT teams can review and reconstruct the automation’s activity via an auditable log. Moreover, in light of data restrictions and geographical nuances (e.g. – from [GDPR](#)) during bot registration, companies can assign and implement restrictions to specific instances or groups of bots or establish rules-governing behaviors.

Enterprise Productivity Suite

Artificial intelligence tools often enter the workplace via IT, delivering deeply technical support. The technology is being rapidly adopted by the back office, offering rich individual employee benefits, too.

Consider BotChain partner [Zoom.AI](#): the company offers a chat-based productivity solution that helps employees offload and automate everyday tasks. With a goal to minimize distractions from operational tasks that erode productivity, the company offers users their own automated assistant to ensure focus on higher-value activities. Zoom handles tasks ranging from meeting scheduling to travel booking to searching enterprise knowledge bases to making warm introductions for meeting preparation. With a recently announced Microsoft Office 365 integration, users will now have access to AI-powered productivity, data, and collaboration tools from a single interface.

The availability and integration advancements from Zoom create immediate value for the rest of the BotChain ecosystem. First, vanguard developers like Zoom help flesh out the technical particulars and operational best practices for partners and participants in the BotChain network. Everyone wants to be an early adopter, but perhaps not the *earliest*. Zoom has already broken the new ground, leaving new developers a known trail to follow.

Second, if one of the goals of BotChain is to coordinate highly competent, highly specialized AI agents into bespoke, composite solutions, the presence of Zoom bots in the BotChain network offers immediate opportunities for follow-on developers. New BotChain participants will already have tools to use, models to follow, and possible iterative solutions to build. Also, they'll have BotChain access to Zoom.ai.

e-Healthcare

Given levels of bot independence and the extent of their communication and transaction capabilities, standard ways to manage the integrity of transactions declines. This reality is of particular concern for AI within healthcare, where, as Global Market Insights [estimates](#), the virtual health assistant market is expected to exceed \$1.5 billion by 2024.

Conversational e-healthcare, or the humanized, user-led and personalized approach to getting health information is growing in popularity. Healthcare providers appreciate the efficiency and intimacy AI can deliver in this context. Concerns persist however; particularly around data exchanging and HIPAA compliance.

Managing bot behavior; including understanding what or who the bot is talking to, where it is disseminating information and what processes it is authorizing, is particularly critical when privacy and confidential data has the likelihood of being shared. Bot inquiry, response and use of potentially confidential data needs to be managed to reduce instances of HIPAA violations. Understandably, the algorithms these technologies use and the way their

capabilities are deployed need to be very precise (and thus, auditable) as medical decisions will stem from their advice and assessments.

With BotChain, healthcare providers and developers creating healthcare servicing bots benefit from the existence of an immutable, transparent method to audit bot interaction and create real-time awareness of what agents are doing, with whom and why.

Team

[Rob May](#)

Rob is a repeat venture-backed entrepreneur and angel investor in 45+ AI and blockchain companies. Previously he was the CEO & Co-Founder of Backupify (Acquired by Datto). He is the author of *Inside AI*.

[Byron Galbraith](#)

Byron has a PhD in Cognitive and Neural Systems from Boston University and an MS in Bioinformatics from Marquette University.

[Jon Klein](#)

Jon has run engineering teams from early stage to large scale. Most recently, he was Director of Engineering at Drync, and lead the Ad Products Team at Tapjoy. He has a M.Sc. in Complex Adaptive Systems from Chalmers University.

[Tara Hendricks](#)

Tara has more than 15 years of financial experience in developing, implementing and managing large, diverse teams. Previous roles include VP of Finance at Kinvey, and the Corporate Controller at Viable Measures, among others. Tara has a BA from Susquehanna University.

[Anthony Habayeb](#)

Most recently, Anthony lead strategy and development for Propel Marketing, now Thrivehive, during its growth from \$6 to \$50M. He previously held partnership and revenue leadership roles at Monster and Yahoo! after starting his career as a strategy consultant with Accenture.

[Henry Wagner](#)

Henry most recently served as a Sr. Software Engineer at Akamai Technologies, where he developed configuration management systems, content distribution systems, and enterprise

on-ramp technologies. He has a BA from Auburn University and pursued graduate studies in Distributed Systems at the University of Connecticut.

[Brooke Torres](#)

Brooke joined Talla Inc in 2015 after advising early stage companies on customer acquisition and go-to-market strategy in the London consumer products market. Before that, she lead social media at The Muse. She holds a BA from Smith College.

[Will Murphy](#)

Will was previously a Principal and corporate entrepreneur within FedEx Innovation, where he led emerging tech venture development initiatives involving technologies like IoT, big data, AI, blockchain, cleantech, and drones.

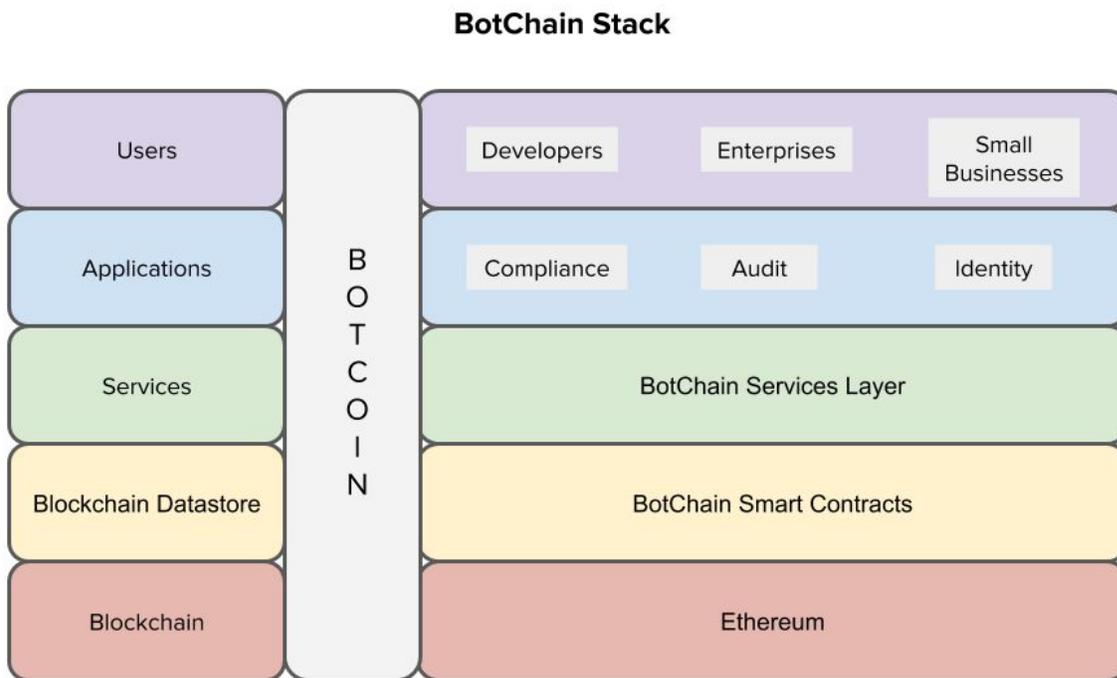
[Catharina Lavers Mallet](#)

Previously, she served as the London Studio General Manager at King Digital Entertainment and held leadership roles at Playfish and Algorithmics, among others. Cat has an MBA from MIT Sloan and a BA from Harvard.

Appendix

Technical Platform Overview

BotChain Network provides the fundamental identity and reputation to enable third party developers to build decentralized applications that help create value for their users. It has been designed for others to build upon and extend the services to meet the additional needs of new and existing market segments.

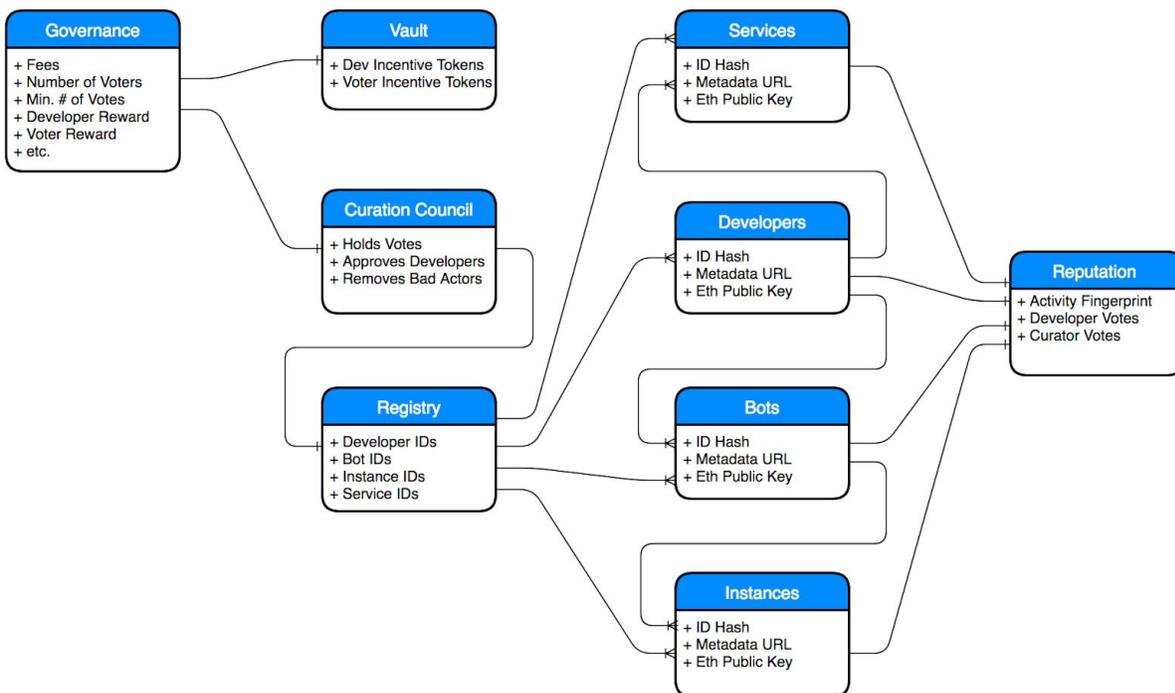


The BotChain Network is comprised of the following elements:

- BotChain smart contracts that run on **Ethereum**.
- BotChain **smart contracts** provide an immutable storage layer, high level network security and overall governance policies for the BotChain network.
- BotChain **services** are provided by verified AI and RPA developers. These services provide key functionality to the ecosystem that enables developers and customers to add transparency and trust to their product offerings.
- **Applications** are built on top of the services to solve autonomous agent use cases like Identity, Audit & Compliance that enable long term adoption of bots and autonomous agents into enterprises.
- **Users** interact with applications build on top of the BotChain Network.

Distributed Application Relationships

Distributed Application (dApp) Structure



Governance Board

The Governance board is best thought of as the group in the system that creates or modifies the rules for all other actors to adhere to. For example, when a developer registers, members of the Curation Council are randomly tasked with voting on whether the developer's ID should be accepted into the registry. The Board can set parameters that influence how many Council members must vote, the period of time for the vote, and the total reward distributed to the voters who participated. In this way, the Board has the ability to affect the internal mechanisms of the system, but does not directly participate in the maintenance of the registry. They are also responsible for the initial verification of Curators that apply to join the network.

Curation Council

The Curation Council is responsible for vetting the authenticity of registrations when they are initially submitted, as well as participating in the active maintenance of the registry. If the Governance Board members are thought of as the rule makers of the system, the Council are the enforcers of the rules. When a registration is received by the network the Council takes part in a voting process. The process begins by randomly selecting a set of curators to participate from the currently approved curators, this helps to mitigate potential biases in work distribution and activity. Upon receiving a work item each curator performs their independent due diligence and supplies their rating of the validity of the applicant. Members who actively participate in the work process are rewarded for their efforts through incentives stored in the Token Vault. This provides a way to motivate members to perform due diligence rather than relying on good faith efforts.

In addition to evaluating initial applications to the network the curators participate in the maintenance of the registry. For each actor in the system a reputation rating is kept, where all actors in the system are able to rate each other. Based on the current rating in the system developers, bots, or specific instances can have their approval revoked. An actors approval can only be officially revoked through a vote by the curation council.

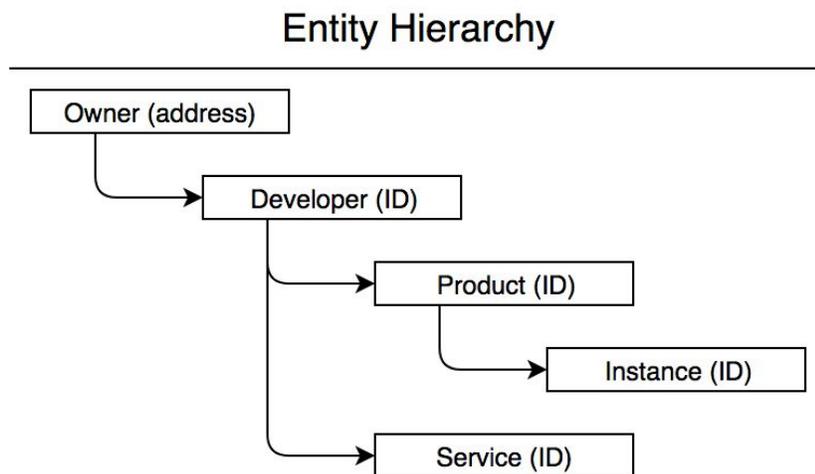
Token Vault

The Vault is a multisignature contract designed to store all tokens related to the incentivization of useful actions within the system. For all transactions where the network charges a fee, the balance is deposited in the vault. Conversely, for all actions where work is done by members of the network, rewards are emitted from the vault. The functions that determine the frequency and rate of all fees and rewards are voted on by the Governance Council.

Registry

Botchain Registry serves as a decentralized and universally accessible whitelist for all accredited Bot Developers and Products. Botchain Registry stores developers, products(a.k.a. bots), instances, and services, which are approved and maintained by the Curation Council. Curators will access a token-weighted voting mechanism through a user interface to vote on whether a developer or bot is accredited or not. The registry maintains the hierarchical relationship of all registered entities.

Developer entries are top level. An address that owns a developer entry can create bot products, instances, or services under their developer entry.



Service

APIs, SDKs, or Services that companies or individuals create outside of the BotChain Core contracts. These are services that are built to provide additional functionality on top of the registry, governance, and curation contracts.

Developer

A company or individual that has an autonomous agent or service they would like to make accessible through BotChain verification methods. Anyone can create a developer entry in an unapproved state. Only the BotChain Curation Council can grant approval to newly registered developers. Each developer entry is attached to a non-fungible token based on ERC-721 that is owned by an address and can be transferred. This allows relationships between developers to change at later dates with approval from the community.

Bot

These correspond to products created by companies or individuals. Each product is linked to a parent developer ID. Only owners of developer entries can create a bot entry. Bots are by default accepted to the registry as long as the parent Developer is currently approved.

Instance

Each bot instance will correspond to a running instance of bot product. Each bot instance is linked to a parent bot product ID. Only owners of developer entries can create bot instances for bot products which they own.

Identity and Reputation

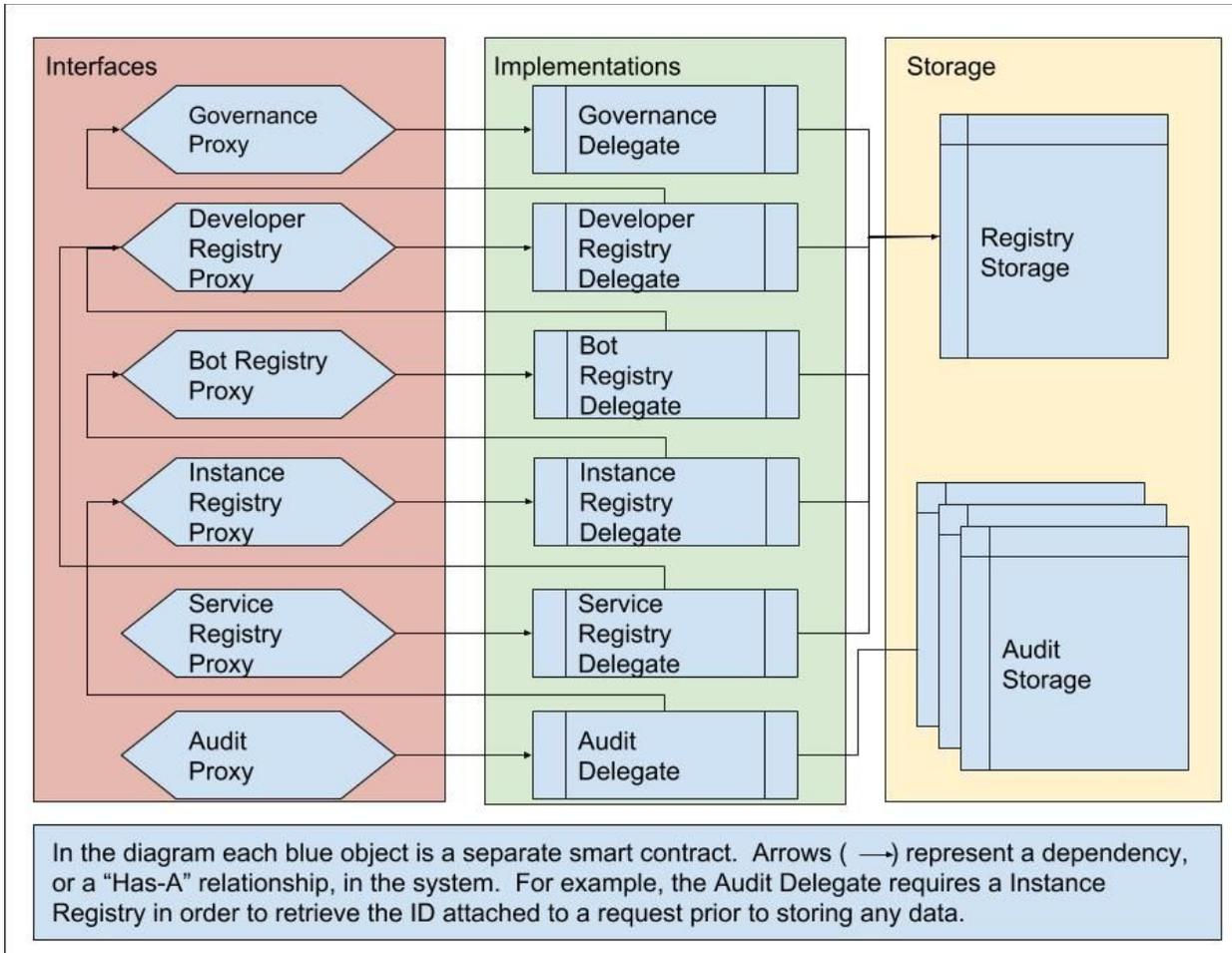
All entities in the registry (Developers, Services, Bots, and Instances) are required to provide metadata about who or what the entry represents. The initial information provided upon registration is used by the Curation Council to determine the initial validity of a registered entity. Throughout the duration of an entity's existence on the registry other registered actors are able to provide additional information regarding the behavior and reliability of an entity. This information can be provided and accessed by any registered actor and actions can be taken by the Curation Council based on the provided information.

Distributed Application Architecture

Given the immutable nature of smart contracts deployed on the Ethereum blockchain and the dynamic nature of our development needs, our initial design goals required us to identify strategies that would grant the benefits of the blockchain while utilizing agile development practices. From this need emerged the idea to implement a Library Driven Development pattern on all BotChain smart contracts for smooth contract upgradability.

We have combined two well established design patterns from the community for upgradability:

- **Proxy/Delegate pattern:** Allows for functionality and business logic upgrades. Originally defined by the Zeppelin Solutions and Aragon teams (<https://blog.zeppelin.solutions/proxy-libraries-in-solidity-79fbe4b970fd>)
- **External Storage:** Separates contract storage from business logic by moving all storage values to a key value store contract. Originally defined by Colony (<https://blog.colony.io/writing-upgradeable-contracts-in-solidity-6743f0eccc88>) and currently used by Zeppelin, Rocket Pool, and others



Interfaces

The interface contracts serve as simple proxy objects, which maintain ownership in the architecture. These contracts point to their respective implementations. When the Core implementation requires an upgrade the relevant delegate contract can be redeployed with new or updated features. Once an updated delegate is deployed the proxy contract can be updated to point to the correct implementation.

Delegates

The delegate contracts provide the most up to date implementation details for a particular path through the system. They define the relationships between the entities in the registry, as well as rules regarding which parts of the state different actors can modify in the system. The implementation currently in use by the overall system can be selected by pointing an interface to the appropriate delegate contract.

Storage

The storage system is broken up into an ownable key-value storage, where only the registry contracts with direct ownership can alter their respective elements. This allows the registries to share a common storage while limiting invalid or malicious access requests. It also provides a unified entry point for each separate type of registry data without drastically increasing the number of calls to delegate contracts. Maintaining the storage as a separate contract allows for the accessors and mutators of the data to be modified while preserving the current state of the system.